IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:)
RAINERI ET AL.)
)
Serial No. **Not Yet Assigned**)
)
Filing Date: **Herewith**)
)
For: **A METHOD FOR MANUFACTURING ISOLATING STRUCTURES**)
)

I HEREBY CERTIFY THIS PAPER OR FEE IS BEING DEPOSITED WITH THE U.S. POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED BELOW AND IS ADDRESSED TO: BOX PATENT APPLICATIONS, ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231.

EXPRESS MAIL NO: EL747059970US

DATE OF DEPOSIT: February 20, 2002

NAME: Dawn Kimler

SIGNATURE: Dawn Kimler

EL747059970US

PRELIMINARY AMENDMENT

Director, U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Prior to the calculation of fees and examination of the present application, please enter the amendments and remarks set out below.

In the Drawings:

Submitted herewith is a request for a proposed drawing modification as indicated in red ink to add a missing reference numeral and to remove an extraneous marking from FIG. 2. FIGS. 1 and 3-20 are also being modified as indicated in red ink to remove extraneous markings therefrom.

In the Specification:

Please replace the paragraph beginning at page 2, line 13, with the following rewritten paragraph:

-- One aspect of the invention is directed to a method for forming isolating structures in a silicon carbide layer. The method comprises depositing a masking layer on

first and second portions of a silicon carbide layer, forming openings through the masking layer to expose the first portions of the silicon carbide layer, and implanting ions into the first portions of the silicon carbide layer.

The silicon carbide layer is preferably heated to form an oxide layer thereon having first portions on the first portions of the silicon carbide layer, and having second portions on the second portions of the silicon carbide layer. The first portions of the oxide layer have a first thickness, and the second portions of the oxide layer have a second thickness less than the first thickness.

The method preferably further includes removing the oxide layer to form isolating regions in the first portions of the silicon carbide layer. Insulation material may be deposited in the isolating regions to form isolating structures. The masking layer may be removed before heating the silicon carbide layer. The ions may comprise heavy ions or a dopant.

Another aspect of the invention is directed to a method for forming isolating trenches for an epitaxially grown diode. The method preferably comprises forming a first epitaxial layer having a first type of conductivity on a silicon carbide layer, and forming a second epitaxial layer having a second type of conductivity on the first epitaxial layer. A masking layer is formed on the second epitaxial layer, and openings are formed through the masking layer to expose first portions of the second epitaxial layer.

The method preferably further comprises removing the first portions of the second epitaxial layer to expose first

portions of the first epitaxial layer, and implanting ions into the first portions of the first epitaxial layer. The first and second epitaxial layers and the silicon carbide layer are heated to form an oxide layer having first portions on the first portions of the first epitaxial layer, and having second portions on the second epitaxial layer.

The first portions of the oxide layer have a first thickness, and the second portions of the oxide layer have a second thickness less than the first thickness. The oxide layer may be removed to form isolating trenches in the first portions of the first and second epitaxial layers. Insulation material may be deposited in the isolating trenches.

Yet another aspect of the invention is directed to a method for isolating an edge of an epitaxially grown diode. After the isolating trenches have been formed as discussed above for the epitaxially grown diode, a ring mask is formed on a peripheral portion of the isolating trenches. Ions are implanted into the isolating trenches to form an implanted region in the first epitaxial layer that extends across a bottom and sidewalls of the trench adjacent the ring mask for isolating the edge of the epitaxially grown diode.

The method preferably further includes removing the ring mask, and heating the first and second epitaxial layers and the silicon carbide layer to form a second oxide layer on the trench and on the second epitaxial layer. A portion of the second oxide layer on the second epitaxial layer may be removed. --

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In the Claims:

Please cancel Claims 1 to 6.

Please add new Claims 7 to 26.

7. A method for forming isolating structures in a silicon carbide layer, the method comprising:

forming a masking layer on first and second portions of a silicon carbide layer;

forming openings through the masking layer to expose the first portions of the silicon carbide layer;

implanting ions into the first portions of the silicon carbide layer; and

heating the silicon carbide layer to form an oxide layer thereon having first portions on the first portions of the silicon carbide layer and having second portions on the second portions of the silicon carbide layer, with the first portions of the oxide layer having a first thickness and the second portions of the oxide layer having a second thickness less than the first thickness.

8. A method according to Claim 7, further comprising:

removing the oxide layer to form isolating regions in the first portions of the silicon carbide layer; and

depositing insulation material in the isolating regions to form isolating structures.

9. A method according to Claim 7, further comprising

removing the masking layer before heating the silicon carbide layer.

10. A method according to Claim 7, wherein the ions comprise heavy ions.

11. A method according to Claim 7, wherein the ions comprise a dopant.

12. A method for forming isolating trenches for an epitaxially grown diode, the method comprising:

forming a first epitaxial layer having a first type of conductivity on a silicon carbide layer;

forming a second epitaxial layer having a second type of conductivity on the first epitaxial layer;

forming a masking layer on the second epitaxial layer;

forming openings through the masking layer to expose first portions of the second epitaxial layer;

removing the first portions of the second epitaxial layer to expose first portions of the first epitaxial layer;

implanting ions into the first portions of the first epitaxial layer;

heating the first and second epitaxial layers and the silicon carbide layer to form an oxide layer having first portions on the first portions of the first epitaxial layer and having second portions on the second epitaxial layer,

with the first portions of the oxide layer having a first thickness and the second portions of the oxide layer having a second thickness less than the first thickness; and

removing the oxide layer to form the isolating trenches in the first portions of the first and second epitaxial layers.

13. A method according to Claim 12, further comprising depositing insulation material in the isolating trenches.

14. A method according to Claim 12, wherein the first epitaxial layer has a first thickness, and the second epitaxial layer has a second thickness less than the first thickness.

15. A method according to Claim 12, further comprising removing the masking layer before heating the first and second epitaxial layers and the silicon carbide layer.

16. A method according to Claim 12, wherein the ions comprise heavy ions.

17. A method according to Claim 12, wherein the ions comprise a dopant.

18. A method according to Claim 12, wherein the second epitaxial layer defines an anode of the diode.

19. A method for isolating an edge of an epitaxially grown diode, the method comprising:

forming a first epitaxial layer having a first type of conductivity on a silicon carbide layer;

forming a second epitaxial layer having a second type of conductivity on the first epitaxial layer;

forming a masking layer on the second epitaxial layer;

forming openings through the masking layer to expose first portions of the second epitaxial layer;

removing the first portions of the second epitaxial layer to expose first portions of the first epitaxial layer;

implanting ions into the first portions of the first epitaxial layer;

heating the first and second epitaxial layers and the silicon carbide layer to form an oxide layer having first portions on the first portions of the first epitaxial layer and having second portions on the second epitaxial layer, with the first portions of the oxide layer having a first thickness and the second portions of the oxide layer having a second thickness less than the first thickness; and

removing the oxide layer to form isolating trenches in the first portions of the first and second epitaxial layers;

forming a ring mask on a peripheral portion of the isolating trenches; and

implanting ions into the isolating trenches to form an implanted region in the first epitaxial layer that extends

across a bottom and sidewalls of the trench adjacent the ring mask for isolating the edge of the epitaxially grown diode.

20. A method according to Claim 19, further comprising:

removing the ring mask; and

heating the first and second epitaxial layers and the silicon carbide layer to form a second oxide layer on the trench and on the second epitaxial layer.

21. A method according to Claim 20, further comprising removing a portion of the second oxide layer on the second epitaxial layer.

22. A method according to Claim 19, wherein the first epitaxial layer has a first thickness, and the second epitaxial layer has a second thickness less than the first thickness.

23. A method according to Claim 19, further comprising removing the masking layer before heating the first and second epitaxial layers and the silicon carbide layer silicon carbide layer.

24. A method according to Claim 19, wherein the ions comprise heavy ions.

25. A method according to Claim 19, wherein the ions comprise a dopant.

26. A method according to Claim 19, wherein the second epitaxial layer defines an anode of the diode.

REMARKS

It is believed that all of the claims are patentable over the prior art. For better readability and the Examiner's convenience, the newly submitted claims differ from the translated counterpart claims which are being canceled. The newly submitted claims do not represent changes or amendments that narrow the claim scope for any reason related to the statutory requirements for patentability. Accordingly, after the Examiner completes a thorough examination and finds the claims patentable, a Notice of Allowance is respectfully requested in due course. Should the Examiner determine any minor informalities that need to be addressed, he is encouraged to contact the undersigned attorney at the telephone number below.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached paper is captioned "Version With Markings to Show Changes Made."

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RAINERI ET AL.
Serial No. **Not Yet Assigned**
Filing Date: **Herewith**

Respectfully submitted,

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Attorneys for Applicants

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Paragraph beginning at page 2, line 13 has been amended as follows:

[Based on this principle, the technical problem is solved by a method as previously indicated and as defined in the characterizing part of Claim 1.] One aspect of the invention is directed to a method for forming isolating structures in a silicon carbide layer. The method comprises depositing a masking layer on first and second portions of a silicon carbide layer, forming openings through the masking layer to expose the first portions of the silicon carbide layer, and implanting ions into the first portions of the silicon carbide layer.

The silicon carbide layer is preferably heated to form an oxide layer thereon having first portions on the first portions of the silicon carbide layer, and having second portions on the second portions of the silicon carbide layer. The first portions of the oxide layer have a first thickness, and the second portions of the oxide layer have a second thickness less than the first thickness.

The method preferably further includes removing the oxide layer to form isolating regions in the first portions of the silicon carbide layer. Insulation material may be deposited in the isolating regions to form isolating structures. The masking layer may be removed before heating

the silicon carbide layer. The ions may comprise heavy ions or a dopant.

Another aspect of the invention is directed to a method for forming isolating trenches for an epitaxially grown diode. The method preferably comprises forming a first epitaxial layer having a first type of conductivity on a silicon carbide layer, and forming a second epitaxial layer having a second type of conductivity on the first epitaxial layer. A masking layer is formed on the second epitaxial layer, and openings are formed through the masking layer to expose first portions of the second epitaxial layer.

The method preferably further comprises removing the first portions of the second epitaxial layer to expose first portions of the first epitaxial layer, and implanting ions into the first portions of the first epitaxial layer. The first and second epitaxial layers and the silicon carbide layer are heated to form an oxide layer having first portions on the first portions of the first epitaxial layer, and having second portions on the second epitaxial layer.

The first portions of the oxide layer have a first thickness, and the second portions of the oxide layer have a second thickness less than the first thickness. The oxide layer may be removed to form isolating trenches in the first portions of the first and second epitaxial layers. Insulation material may be deposited in the isolating trenches.

Yet another aspect of the invention is directed to a method for isolating an edge of an epitaxially grown diode. After the isolating trenches have been formed as discussed above for the epitaxially grown diode, a ring mask is formed

on a peripheral portion of the isolating trenches. Ions are implanted into the isolating trenches to form an implanted region in the first epitaxial layer that extends across a bottom and sidewalls of the trench adjacent the ring mask for isolating the edge of the epitaxially grown diode.

The method preferably further includes removing the ring mask, and heating the first and second epitaxial layers and the silicon carbide layer to form a second oxide layer on the trench and on the second epitaxial layer. A portion of the second oxide layer on the second epitaxial layer may be removed.

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EXPRESS MAIL NO: EL747059970US

DATE OF DEPOSIT: February 20, 2002

NAME: Dawn Kimler

SIGNATURE: Dawn Kimler

SUBMISSION OF PROPOSED MODIFICATIONS TO DRAWINGS

Director, U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Submitted herewith is a request for a proposed drawing modification as indicated in red ink to add a missing reference numeral and to remove an extraneous marking from FIG. 2. FIGS. 1 and 3-20 are also being modified as indicated in red ink to remove extraneous markings therefrom.

Respectfully submitted,

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Attorney for Applicants

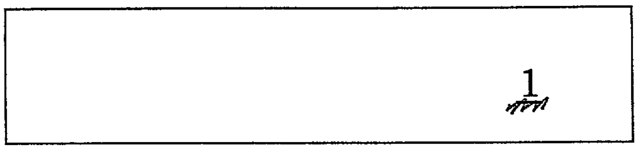

FIG. 1

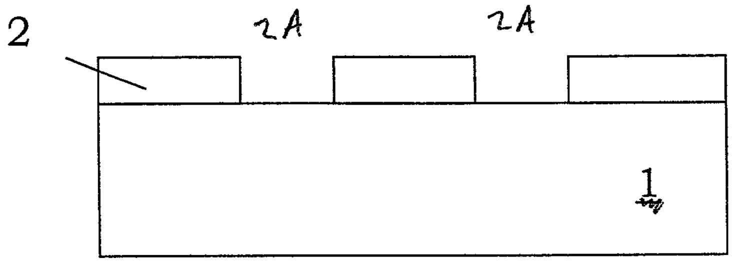

FIG. 2

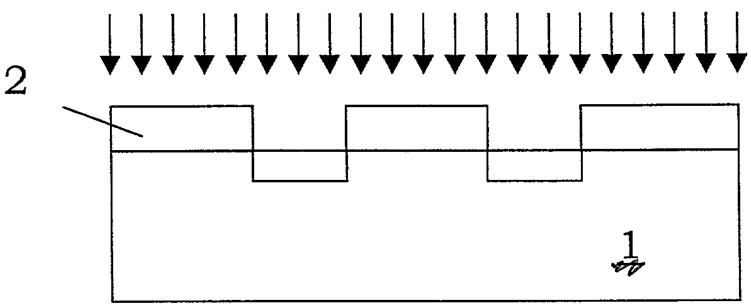

FIG. 3

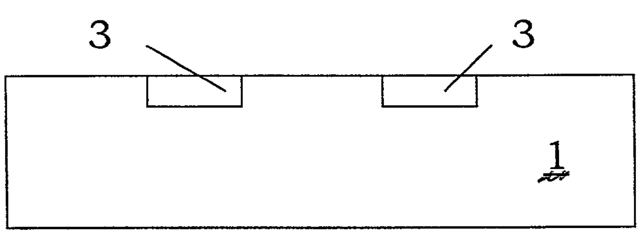

FIG. 4

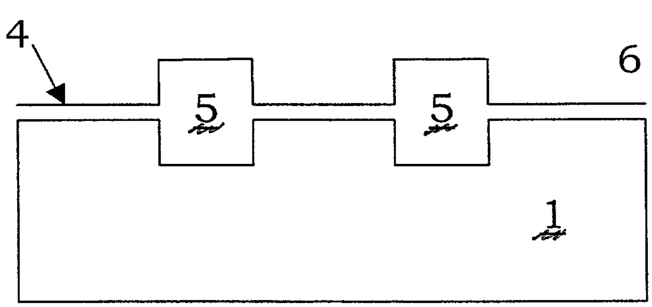

FIG. 5

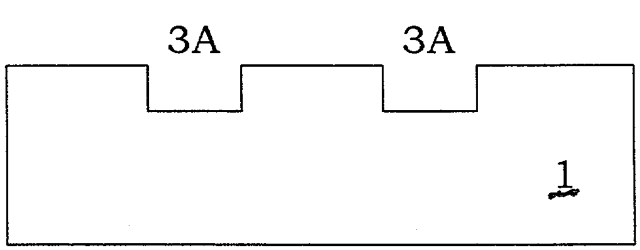

FIG. 6

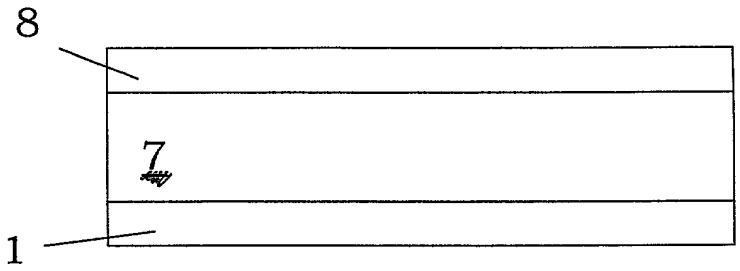

FIG. 7

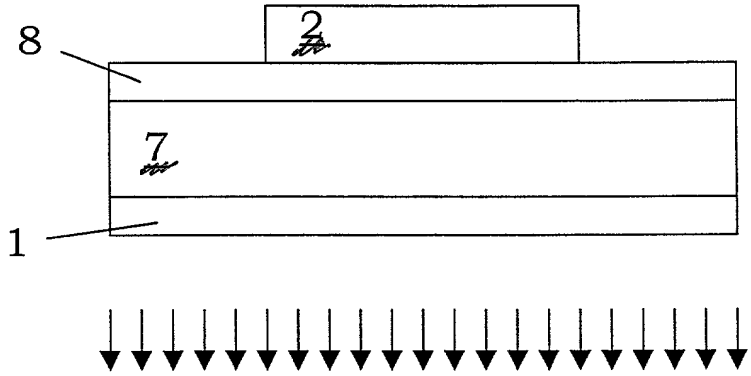

FIG. 8

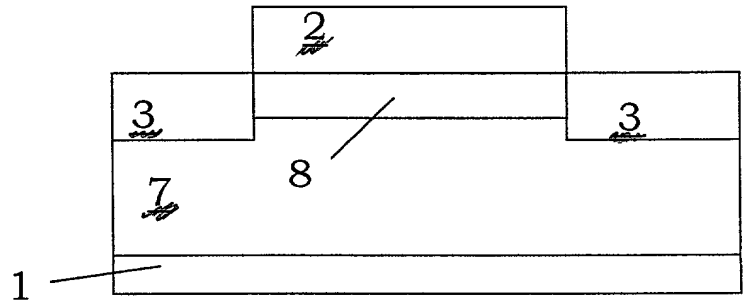

FIG. 9

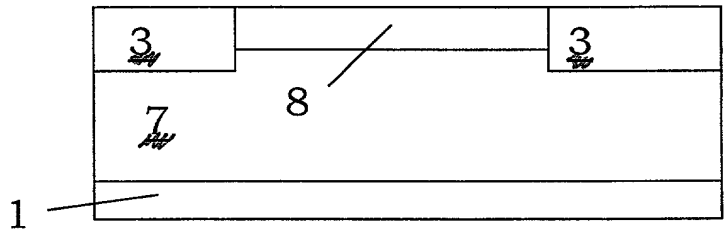

FIG. 10

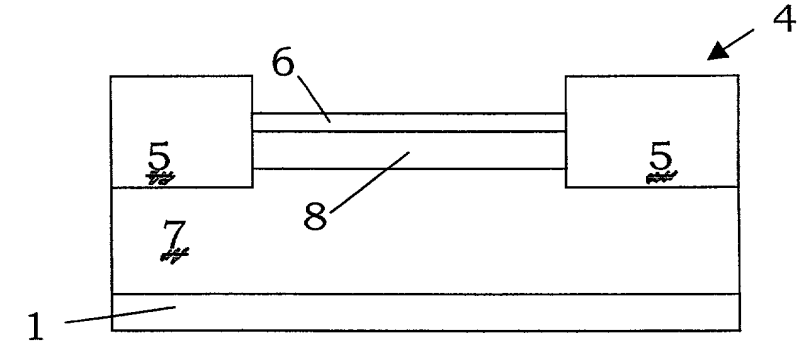

FIG. 11

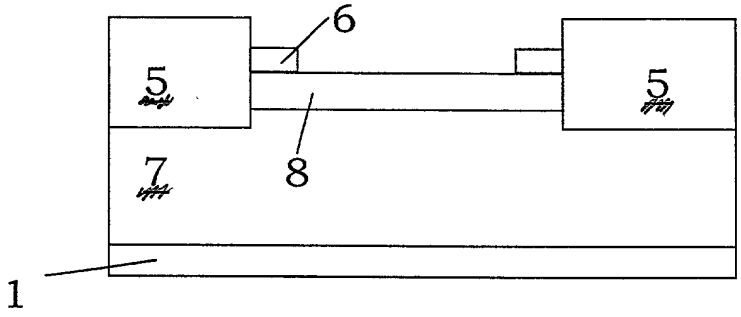

FIG. 12

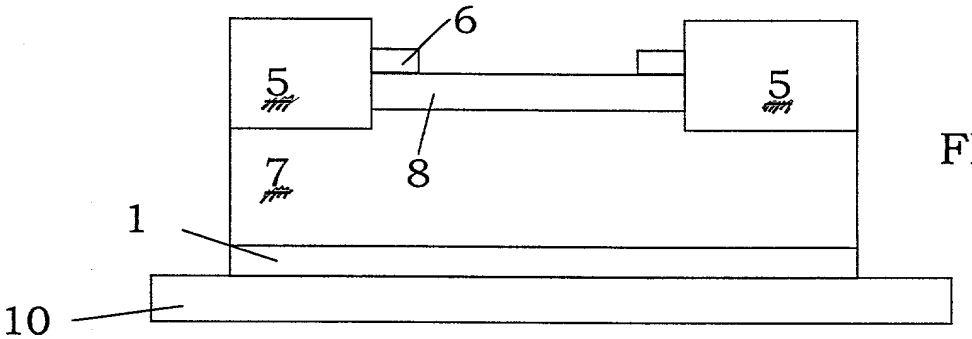

FIG. 13

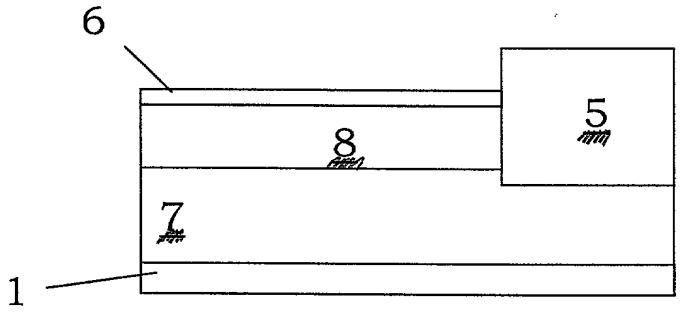

FIG. 14

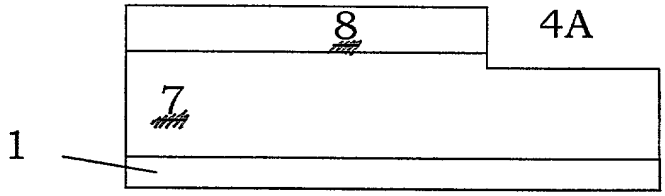

FIG. 15

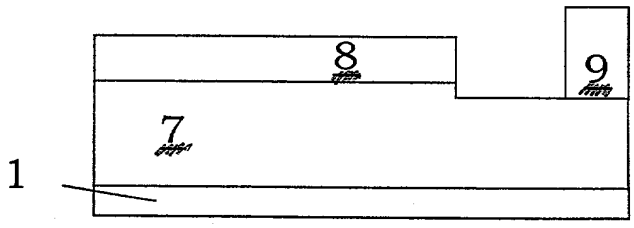

FIG. 16

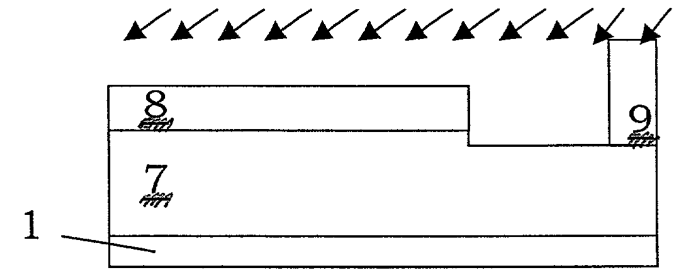

FIG. 17

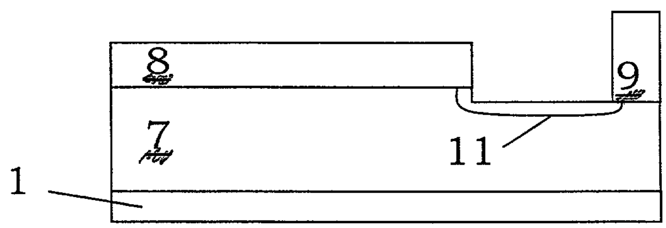

FIG. 18

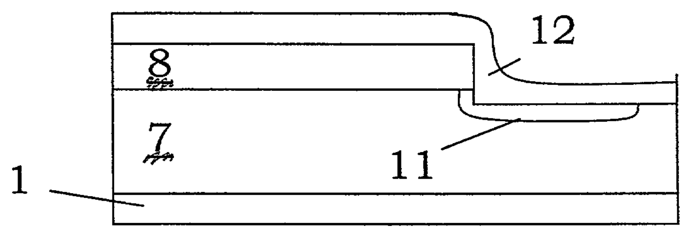

FIG. 19

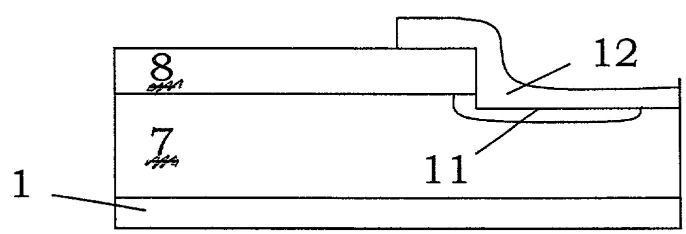

FIG. 20